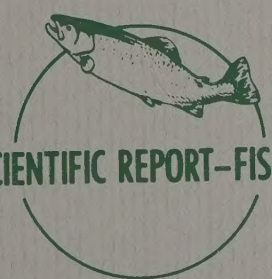
U.S.F.W.S.
SK361
A257t
551

Preliminary Report on the Feeding Habits of Tunas in the Gulf of Guinea

by Paul N. Sund and William J. Richards

LIBRARY
JAN 25 1957
FISH & WILDLIFE SERVICE



SPECIAL SCIENTIFIC REPORT–FISHERIES No. 551

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

UNITED STATES DEPARTMENT OF THE INTERIOR
Stewart L. Udall, *Secretary*
Charles F. Luce, *Under Secretary*
Stanley A. Cain, *Assistant Secretary for Fish and Wildlife and Parks*
FISH AND WILDLIFE SERVICE, Clarence F. Pautzke, *Commissioner*
BUREAU OF COMMERCIAL FISHERIES, Harold E. Crowther, *Director*

Preliminary Report on the Feeding Habits of Tunas in the Gulf of Guinea

By

PAUL N. SUND and WILLIAM J. RICHARDS

United States Fish and Wildlife Service
Special Scientific Report--Fisheries No. 551

Washington, D.C.
July 1967

CONTENTS

	Page
Introduction	1
Methods	1
Stomach contents	3
Acknowledgments	5
Literature cited	5

Preliminary Report on the Feeding Habits of Tunas in the Gulf of Guinea[1]

By

PAUL N. SUND, Oceanographer

and

WILLIAM J. RICHARDS, Research Systematic Zoologist

Tropical Atlantic Biological Laboratory
Bureau of Commercial Fisheries
Miami, Florida 33149

ABSTRACT

The stomachs of 171 yellowfin tuna (Thunnus albacares) and 72 skipjack tuna (Katsuwonus pelamis), captured in the Gulf of Guinea, contained mostly fishes, cephalopods, and crustaceans. The percentage composition by volume of these three food categories was: 55, 19, and 8 for yellowfin tuna; 96, 1, and 2 for skipjack tuna. The percentage frequency of occurrence was: 76, 40, and 53 for yellowfin tuna; 73, 14, and 22 for skipjack tuna. The occurrence of forage species varied little in geographic areas within the region, but differences did occur between the food species found in stomachs of fish captured in the "warm" and "cool" seasons. A trematode parasite of the genus Hirudinella was found in stomachs of both tuna species.

INTRODUCTION

A major objective of the Tropical Atlantic Biological Laboratory is to aid the U.S. fishing industry, and the peoples of nations bordering the tropical Atlantic Ocean, through studies that will increase knowledge of marine food resources. Recently emphasis has been directed toward an investigation of the tuna resources in the Gulf of Guinea. A significant part of this program is the description of the components of the nekton community upon which tunas feed, because the distribution and movements of tunas often are directly related to the availability of proper forage.

This is a preliminary report on the forage-predator relation of tuna stocks in the Gulf of Guinea. Studies of the food of tunas are numerous, but none exist that concentrate on the Gulf of Guinea, and only a few deal with the tropical Atlantic Ocean (Beebe, 1936; Postel, 1954; Anderson, Gehringer, and Cohen, 1956a, b; Anderson and Gehringer, 1956, 1957a, b, 1958a, b, 1959a, b, c; Suarez-Caabro and Duarte-Bello, 1961). Alverson (1963) reviewed the literature on the food habits of tunas and concluded that despite their widely varied diet, tunas in a given locality ate in quantity only a small variety of forage organisms.

METHODS

The samples on which this report is based were collected during January-May and July-October 1964, on cruises of the research vessel Geronimo of the Bureau of Commercial Fisheries. The collections were made in the Gulf of Guinea between long. 7° 30' W. and long. 3° 30' E., within about 100 nautical miles (185 km.) of the West African coast. The area covered and the locations of tuna sightings and captures of yellowfin tuna (Thunnus albacares) and skipjack tuna (Katsuwonus pelamis) are shown in figure 1.

During the surveys, 171 yellowfin and 72 skipjack tunas were examined. The plan of the field program was to catch at least 25 fish from every yellowfin and skipjack school encountered. Actual numbers taken from each school successfully fished ranged from 1 to 49, or an average of 5.

The fork length, weight, and sex of each fish were recorded, and the stomach and gonads (females only) were removed and

[1] Contribution No. 41, Bureau of Commercial Fisheries Tropical Atlantic Biological Laboratory, Miami, Fla. 33149.

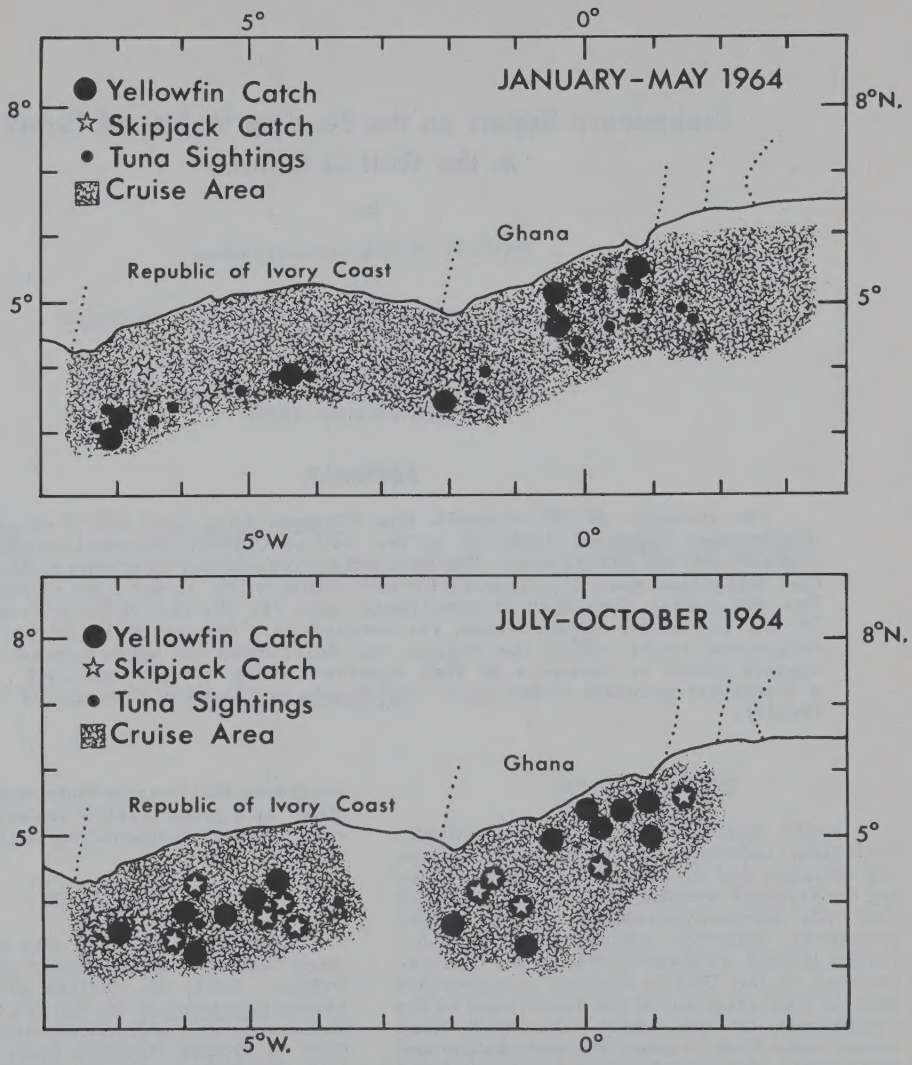


Figure 1.--Area surveyed and location of sightings of tunas (small dot) and catches of yellowfin (large dot) and skipjack (star) tunas, January-May and July-October 1964.

frozen. Later, in the laboratory, the wet-displacement volume of the contents of each stomach was measured, and the food organisms were identified to the lowest possible taxonomic unit. The volume and number of specimens in each taxon were recorded to determine the relative volume and the numerical importance of the various forage organisms and groups. Bait fishes used for chumming were not included in the calculations.

STOMACH CONTENTS

Food was present in 83 percent of the yellowfin tuna stomachs and 51 percent of the skipjack tuna stomachs. The contents consisted mainly of three categories: fishes, cephalopods, and crustaceans (table 1). Other items included salps, pteropods and heteropods, and parasites.

Table 1.--Percentage composition by volume and percentage frequency of occurrence of the food consumed by yellowfin and skipjack tunas captured from the Gulf of Guinea, 1964. Fish with empty stomachs were not included.

Species	Food		
	Fishes	Cephalopods	Crustaceans
	Percent by volume		
Yellowfin tuna	55	19	8
Skipjack tuna	96	1	2
	Percent frequency of occurrence		
Yellowfin tuna	76	40	53
Skipjack tuna	73	14	22

Certain species of forage nekton appeared in the stomachs of tunas more often than others (table 2). Organisms commonly found in yellowfin tuna stomachs were: Vomer setapinnis, Auxis sp., Acanthurus sp., Dactylopterus volitans, Abralia veranyi, Bathypolypus sponsalis, Illex illecebrosus coindetii, Onycoteuthis banksi, Brachyscelus sp., pagurid larvae, brachyuran larvae, and stomatopod larvae. Skipjack tuna stomachs frequently contained D. volitans and pagurid larvae.

Some forage species were found exclusively in yellowfin tuna stomachs, but others were used as food by both skipjack and yellowfin tunas. The use of the same species might be interpreted as an example of direct competition for certain forage organisms, but competition is extremely difficult to document because of the many factors that tend to reduce it (Gause and Witt, 1935). The possibility that these two species may compete for food should be considered in future investigations.

The occurrence of forage species varied little in geographic areas within the region. Some species were found only off the Republic of Ivory Coast or off Ghana but were taken so seldom that no conclusions on their occurrence are justified. Stomatopod larvae were abundant in stomachs of tunas collected off Ivory Coast during January-May and off Ghana during July-October, possibly because the larvae were transported westward by the Guinea Current, or because the spawning area of the adult population shifted.

Seasonal differences were apparent in the occurrence of some organisms in the tuna stomachs. Anchoviella guineensis, Bathypolypus sponsalis, and Abralia veranyi were found only in stomachs of fish taken during the "cool" season. Hippocampus sp., Trichiurus sp., an unidentified gonastomatid, Oxyporhamphus micropterus, Atlanta sp., Illex illecebrosus, and a species of unidentified salp were present only in samples taken during the "warm" season. Other species of fishes and invertebrates either did not differ in time of occurrence or varied so much between samples that their seasonal distribution could not be determined.

The relation of hydrographic conditions to feeding of tunas is undetermined. The surface waters of the Gulf of Guinea exhibit seasonal variations in physical and chemical characteristics (Longhurst, 1962). In the "warm" season (February-April) the waters are characterized by higher temperatures (28°-31° C.) and salinity values of 34.0 to 35.0 p.p.t. (parts per thousand). In the "cool" season (July-September), the water temperatures are from 22° to 25° C., and the salinities range from 32 to 36 p.p.t.

Stomachs from both yellowfin and skipjack tunas contained an unidentified species of Hirudinella (Trematoda). This parasite was found 5 times (in 4 yellowfin tuna and 1 skipjack tuna) in stomachs collected during January-May, and 14 times (in 12 yellowfin tuna and 2 skipjack tuna) in stomachs collected during July-October. Both sexes and a wide size range of each species were infected.

Table 2.--Percentage frequency of occurrence of the food items consumed by yellowfin and skipjack tunas captured in the Gulf of Guinea during 1964.

Food item	January-May		July-October	
	Yellowfin	Skipjack	Yellowfin	Skipjack
Invertebrates:				
Amphipods:				
Brachyscelus sp.	14.7	--	15.3	--
Phronima sedentaria	1.5	--	--	--
Phrosima semilunata	1.5	5.9	--	--
Copepods:				
Penella exocoeti	1.5	--	--	--
Decapods:				
Brachyura megalops	10.3	--	5.6	--
Pagurus sp. (larvae)	33.8	--	1.4	--
Phyllosoma larvae	2.9	--	2.8	--
Unidentified shrimps	23.5	--	9.7	31.3
Euphausiids:				
Euphausia sp.	4.4	--	--	--
Stomatopods:				
Unidentified larvae and postlarvae	13.2	--	33.3	--
Cephalopods:				
Abralia veranyi	4.4	--	9.7	6.3
Bathypolypus sponsalis	1.5	--	12.5	--
Illex illecebrosus coindetii	7.4	--	--	--
Ommastrephes pteropus	1.5	--	1.4	--
Onycoteuthis banksi	7.4	--	--	--
Onykia appelofii	2.9	--	--	--
Todarodes sagittatus	1.5	--	--	--
Unidentified cephalopods	48.5	5.9	4.2	6.3
Gastropods:				
Atlanta sp.	2.9	--	--	--
Tunicates:				
Unidentified salps	30.9	11.8	--	--
Vertebrates:				
Engraulids:				
Anchoviella guineensis	--	--	18.1	43.8
Gonostomatids:				
Unidentified	2.9	--	--	--
Sternoptychids:				
Sternoptyx diaphana	1.5	--	1.4	--
Exocoetids:				
Oxyporhamphus micropterus	1.5	11.8	--	--
Syngnathids:				
Hippocampus sp.	5.9	--	1.4	--
Berycoids:				
Unidentified	1.5	--	1.4	--
Carangids:				
Vomer setapinnis	8.8	--	15.3	--
Scombrids:				
Euthynnus alletteratus	4.4	--	--	--
Auxis sp.	10.3	--	4.2	--
Unidentified	1.5	--	1.4	--
Gempylids:				
Unidentified	16.2	5.9	2.8	12.5
Trichiurids:				
Trichiurus sp.	2.9	5.9	--	--
Stromateids:				
Psenes cyanophrys	2.9	--	--	--

Table 2.--Con.

Food item	January-May		July-October	
	Yellowfin	Skipjack	Yellowfin	Skipjack
Vertebrates--Con.				
Acanthurids:				
Acanthurus sp.	13.2	11.8	2.8	--
Dactylopterids:				
Dactylopterus volitans	2.9	23.5	--	--
Tetraodontids:				
Unidentified	1.5	--	1.4	--
Unidentified eel larvae	1.5	--	1.4	--
Unidentified fish remains	48.5	52.9	41.7	12.5
Number captured	83	44	84	24
Number with forage	68	17	72	16

ACKNOWLEDGMENTS

G. L. Voss and C. Roper of the Institute of Marine Science, University of Miami, verified identifications of the cephalopods.

LITERATURE CITED

ALVERSON, FRANKLIN G.
1963. The food of yellowfin and skipjack tunas in the Eastern Tropical Pacific Ocean. Inter-Amer. Trop. Tuna Comm. Bull. 7(5): 293-367 (English), 368-396 (Spanish).

ANDERSON, WILLIAM W., and JACK W. GEHRINGER.
1957a. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, Theodore N. Gill cruise 3. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 210, 208 p.
1957b. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V Theodore N. Gill cruise 4. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 234, 192 p.
1958a. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V Theodore N. Gill cruise 5. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 248, 220 p.
1958b. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V Theodore N. Gill cruise 6. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 265, 99 p.
1959a. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V Theodore N. Gill cruise 7. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 278, 277 p.
1959b. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V Theodore N. Gill cruise 8. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 303, 227 p.
1959c. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V Theodore N. Gill cruise 9. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 313, 226 p.

ANDERSON, WILLIAM W., JACK W. GEHRINGER, and EDWARD COHEN.
1956a. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, M/V Theodore N. Gill cruise 1. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 178, 160 p.
1956b. Physical oceanographic, biological, and chemical data, South Atlantic coast of the United States, Theodore N. Gill cruise 2. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 198, 270 p.

BEEBE, WILLIAM.
1936. Food of the Bermuda and West Indian tunas of the genera Parathunnus and Neothunnus. Zoologica 21: 195-205.

GAUSE, G. F., and A. A. WITT.
1935. Behavior of mixed populations and the problem of natural selection. The Amer. Natur. 69(725): 596-609. (Also In: Readings in Population and Community Ecology edited by William E. Hazen. W. B. Saunders Co., Philadelphia and London, 1964.)

LONGHURST, ALAN R.
1962. A review of the oceanography of the Gulf of Guinea. Bull. Inst. Fr. Afr. Noire 24(A) (3): 633-663.

POSTEL, E.
1954. Contribution a l'etude de thonides de l'Atlantique tropical. J. Cons. 19: 356-362.

SUAREZ-CAABRO, J. A., and P. P. DUARTE-BELLO.
1961. Biologia pesquera del bonito (Katsuwonus pelamis) y la albacora (Thunnus atlanticus) en Cuba. I. Ser. Estud. Trab. Invest. Inst. Cub. Invest. Technol. 15, 151 p.

MS. #1609

Created in 1849, the Department of the Interior--a department of conservation--is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States--now and in the future.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES
WASHINGTON, D.C. 20240

OFFICIAL BUSINESS

Return this sheet to above address, if you do NOT wish to receive this material ☐, or if change of address is needed ☐ (indicate change including ZIP Code).

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF THE INTERIOR